



Endoscopic middle meatal antrostomy in treatment of maxillary sinus mucocoeles

Endoskopska antrostomija pristupom iz srednjeg nosnog hodnika u terapiji mukokela maksilarnog sinusa

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Abstract

Background/Aim. Mucocoele of a paranasal sinus is a benign non-neoplastic condition characterized by cystic expansion and distension of the sinus cavity by retained mucoid secretions. Etiology is unknown. The purpose of this study was to estimate the efficiency of the endoscopic middle meatal antrostomy (MMA) as a treatment modality in patients with maxillary sinus mucocoeles. **Methods.** This retrospective study involved 11 patients with maxillary sinus mucocoeles/pyocoeles treated endoscopically in the Clinic for Otorhinolaryngology of Military Medical Academy, Belgrade over a 3-year period (2005–2007). The presented symptoms and signs, radiological and pathohistological findings and surgical treatment were reviewed. **Results.** There were four females and seven males, age 22 to 65 years (mean 33 years). Two patients were with allergic rhinitis. All the patients complained of nasal obstruction, ten had facial pain, seven had nasal discharge, five had cheek pressure, and four had epiphora, and four had headaches. On endoscopic nasal examination, the medial wall of the maxillary sinus was bulging in ten patients. Purulent drainage was seen in eight patients, septal deviation in ten, and polyps were found in two of the patients. The MMA and marsupialization of the mucocoele were performed in all the patients. On histopathological examination, the mucocoele wall showed a lining composed of respiratory epithelium. Postoperative follow-up ranged between 8 and 44 months (in six patients, it ranged from 24 to 44 months). No patients required revision surgery. **Conclusion.** The MMA with mucocoele marsupialization abolishes middle meatal obstruction and establishes better drainage and ventilation of the maxillary sinus and restitution of its mucosa.

Key words:

mucocoele; maxillary sinus; therapeutics; endoscopy; otorhinolaryngologic surgical procedures; treatment outcome.

Apstrakt

Uvod/Cilj. Mukokela paranasalnog sinusa je benigna, netumorska lezija, koju karakteriše cistična ekspanzija i distenzija sinusne duplje usled nagomilavanja mukoidnog sadržaja. Samo 10% mukokela nalazi se u maksilarnim sinusima. Etiologija je nepoznata. Cilj studije bio je da se proceni efikasnost endoskopske antrostomije pristupom iz srednjeg nosnog hodnika kao načina lečenja bolesnika sa mukokelama maksilarnog sinusa. **Metode.** Retrospektivnom studijom obuhvaćeno je 11 bolesnika sa mukokelom maksilarnog sinusa operisanih endoskopski u Klinici za otorinolaringologiju Vojnomedicinske akademije, Beograd tokom trogodišnjeg perioda (2005–2007). Prikazani su klinički simptomi i znaci, radiološki i patohistološki nalazi, kao i načini hirurškog lečenja. **Rezultati.** Studija je obuhvatila četiri žene i sedam muškaraca životne dobi od 22 do 65 godina (prosečno 33 godine). Svi bolesnici patili su od opstrukcije nosa, 10 je imalo bolove u licu, sedam pojačanu nosnu sekreciju, pet osećaj pritiska u predelu obraza, četiri epiforu, a četiri glavobolje. Endoskopskim pregledom nađeno je izbočenje medijalnog zida maksilarnog sinusa kod deset bolesnika. Purulentna sekrecija nađena je kod osam bolesnika, devijacija septuma kod deset, a polipi kod dva bolesnika. Svi bolesnici operisani su endoskopskom antrostomijom i marsupijalizacijom mukokele, pristupom iz srednjeg nosnog hodnika. Histopatološkim pregledom nađeno je da je sluzokoža mukokela imala respiratorni epitel. Postoperativni kontrolni period bio je između osam i 44 meseca (kod šest bolesnika on je bio između 24 i 44 meseca). Ni kod jednog bolesnika nije bilo potrebe za reoperacijom. **Zaključak.** Endoskopska antrostomija pristupom iz srednjeg nosnog hodnika sa marsupijalizacijom mukokele uklanja opstrukciju srednjeg nosnog hodnika, poboljšava drenažu i ventilaciju i dovodi do oporavka sluzokože maksilarnog sinusa.

Ključne reči:

mukokela; maksilarni sinus; lečenje; endoskopija; hirurgija, otorinolaringološka, procedure; lečenje, ishod.

Introduction

Mucocele is a benign non-neoplastic condition characterized by cystic expansion of a paranasal sinus by retained mucoid secretions¹. In the literature, involvement of the frontal sinus (between 50% and 65% of the cases) and the anterior ethmoid cells (30% of the cases) is more frequent. The maxillary sinus is a less common site of development, with only 10% of the cases². In rare cases, mucoceles were found on an uncommon location: orbital floor, pterygo-maxillary space, nasal bone and pneumatized middle turbinate^{3,4}. Bilateral mucoceles are extremely rare. Only several cases have been reported⁵.

Mucoceles are created by occlusion of the affected sinus ostia. It is hypothesized that continued mucus production accumulates within a sinus that has partial or complete lack of drainage, causing secondary expansion of the sinus. Continuous expansive growth of the mucocele can lead to eventual involvement of neighbouring sinuses or extrasinusoidal structures¹. Expansion of the sinus cavity and extension into adjacent structures are the result of bone erosion or destruction¹. The most likely mechanism for bone destruction is continuous, mechanical pressure with secondary ischemia, bone necrosis, and eventual resorption¹. However, the presence of osteolytic cytokines within the mucocele wall has been reported^{1,6}. Bone resorbing substances, prostaglandin E2 (PGE2) and collagenases have been demonstrated in the lining of mucoceles^{6,7}. The obstruction of the maxillary sinus ostium is a result of chronic inflammation, allergic reaction, trauma, previous surgery or a tumor mass⁶. When the mucocele content is predominantly purulent, it is commonly known as a pyocele. Maxillary sinus mucoceles can be divided into the primary and secondary. The commonest cause of secondary mucoceles is trauma, either iatrogenic and accidental⁸. When we find the sinus expansion or bone destruction, the differential diagnosis includes benign and malignant lesions of the paranasal sinuses. In the absence of bone erosion, mucoceles must be differentiated from antrochoanal polyps, chronic rhinosinusitis and retention cysts.

The treatment of maxillary sinus mucoceles is surgical: external approaches, including Caldwell-Luc procedure and endoscopic sinus surgery (ESS) with marsupialization^{2,5,9}. Over the past decade, intranasal drainage and marsupialization of mucocele, using ESS has emerged as definitive management, with minimal morbidity and a low recurrence rate⁹. The objectives of surgical treatment include correction of any underlying conditions, decompression of the mucocele by providing appropriate drainage and aeration to the affected sinus, and, in some instances, complete surgical excision of the lesion^{1,10}.

The purpose of this study was to estimate the efficiency of the endoscopic middle meatal antrostomy (MMA) as a treatment modality in patients with maxillary sinus mucoceles.

Methods

This retrospective study included 11 patients with maxillary sinus mucoceles subjected to endoscopic sinus surgery in the Clinic for Otorhinolaryngology of Military Medical Acad-

emy in Belgrade over the period between the January 1, 2005 and the December 31, 2007. The diagnosis was made on the basis of the symptoms, physical examination (anterior rhinoscopy and nasal endoscopy), computed tomography (CT) of the paranasal sinuses in both the coronal and axial plane, findings in the operation field and histopathological analysis. At CT scan, maxillary mucocele was defined as hypodense mass of mucoid attenuation that completely filled the maxillary cavity with the evidence of expansion and/or bone erosion. We included only patients whose histopathological findings confirmed the preoperative diagnosis. In all of the patients, we performed the ESS. Middle meatal antrostomy (MMA) was the main surgical procedure. All the patients were with primary mucoceles, without previous surgery and trauma. Bacteriological examination of the nasal secret isolated from the middle meatus was done in all the patients. Only patients with pathogen bacteria isolated from the cultured pus were treated firstly by antibiotics. The surgery was performed under general anesthesia. Mucosal decongestion was obtained by applying small cotton gauzes soaked in a solution of cocaine 5% with adrenaline 1 : 5 000. The middle turbinate was medialized. The middle meatal structures were identified using a 0-degree endoscope. After incising of uncinat process mucosa, the uncinat process was resected using a Blakesley-type forceps. Thus, we performed infundibulotomy. The ethmoid bulla was opened and resected using a small forceps. The ostium was visualized and probed with a curved Ritter probe using a 30-degree endoscope. The ostium was enlarged with Blakesley forceps and a backbitting bone punch. After that, we marsupialized and aspirated the mucocele content. Glove finger pack were applied in the middle meatus. A gauze pack with ointment was applied between the middle turbinate and the septum, and left there for five days. After the surgical treatment, all the patients were treated by amoxicillin-clavulanate (in a dose of 625 mg, three times per day) for seven days. The patients were observed weekly with nasal washing with saline solution. Thereafter, the patients were examined, every two months the first year, then three times a year.

Depending on the case, we included other surgical procedures, inferior meatal antrostomy (IMA), septoplasty, lateral laminectomy and polypectomy.

For histopathological analysis (Hematoxylin & Eosin stain), we used specimens of mucocele walls through the middle meatal or inferior meatal antrostomas.

The postsurgical follow-up period ranged from 8 to 44 months (mean 25.5 months). In six patients, postoperative follow-up ranged from 24 to 44 months. The surgical outcomes were assessed on the basis of resolving the presented symptoms, patency of middle meatal antrostoma, appearance of maxillary sinus and middle meatal mucosa and need for revision surgery.

Results

Epidemiology

Between January 1, 2005 and December 31, 2007, 11 patients (seven men, four women) with maxillary sinus mu-

cocceles/pyocceles were operated. The age of the patients ranged from 22 to 65 (mean, 33 years). Two patients were with allergic rhinitis and two with nasal polyposis. The shortest interval before mucocele/pyocele presentation was two years, the longest 13 years.

Location of the mucoceles/pyocceles

Seven lesions were located within the left and four were within the right maxillary antrum. In four patients, mucoceles extended into ethmoid sinus. All mucoceles/pyocceles were unilateral.

Symptoms and signs

All the patients complained of nasal obstruction, ten patients had facial pain, five had cheek pressure, seven had nasal discharge, four had epiphora, and four had headaches (Table 1). On endoscopic nasal examination, the medial wall of the

Bacteriological findings

Bacteriological cultures grew organisms in five patients. *Staphylococcus aureus* grew in cultured pus in four patients and *Streptococcus pneumoniae* in one.

Surgical treatment

All mucoceles/pyocceles were managed by endoscopic infundibulotomy and MMA with marsupialization of the mucocele (Figure 2). According to the appearance of its liquid content, eight maxillary lesions were mucoceles, and three were pyocceles. In six, we performed IMA simultaneously with MMA. In ten, we performed septoplasty and in two polypectomy. In two patients, we performed lateral resection of the concha bullosa (lateral lamnectomy) (Table 1). There were no intraoperative or postoperative complications.

Table 1

Characteristics of patients with maxillary sinus mucoceles and surgical procedures performed

Patient	Age	Sex	Side	Symptoms	Surgery	Follow-up (months)
1	33	Male	Left	NO, FP, ND	MMA, S	30
2	26	Male	Right	NO, FP, ND, E	MMA, IMA, S	22
3	44	Female	Left	NO, CP, E, H	MMA, IMA, S	24
4	32	Male	Left	NO, FP, ND, H	MMA, IMA, LL, S	10
5	22	Male	Right	NO, FP, CP, H	MMA, S	38
6	65	Female	Left	NO, FP, CP, E	MMA, S	44
7	30	Male	Right	NO, FP, ND, E	MMA, IMA, LL, S	23
8	27	Female	Right	NO, FP, CP, H	MMA, S, P	38
9	22	Male	Left	NO, FP, ND, E	MMA, IMA	8
10	36	Female	Left	NO, FP, ND, CP	MMA, S, P	15
11	25	Male	Left	NO, FP, ND	MMA, IMA, S	28

NO –nasal obstruction; FP – facial pain; ND – nasal discharge; E – epiphora; CP – cheek pressure; H – headache; MMA – middle meatal antrostomy; S – septoplasty; IMA – inferior meatal antrostomy; LL – lateral lamnectomy; P – polypectomy

maxillary sinus was bulging in ten patients, in five with prolapsed middle meatus mucosa. Purulent drainage was seen in eight patients, septal deviation in ten patients, ipsilateral antrochoanal polyp in one, and nasal polyposis in one patient, too.

Computed tomography (CT)

Computed tomography reveals a diffuse opacity with mucoid attenuation and thinning of the walls of the sinus in all the patients. Four patients had mucosal thickening of the ipsilateral ethmoid sinus. There was bulging of the medial wall of the maxillary sinus in 10 patients (Figure 1 A and B, Figure 2).

Histopathological features

The mucocele wall fragments showed a lining composed of respiratory epithelium with variable flattening and attenuation of the pseudostratified epithelium. There were submucosal fibrosis with an infiltrate of lymphocytes, plasma cells and variable numbers of eosinophils (Figure 3).

Long-term treatment outcome

In six of eleven patients, postoperative follow-up ranged between 24 and 44 months. In all the patients, the

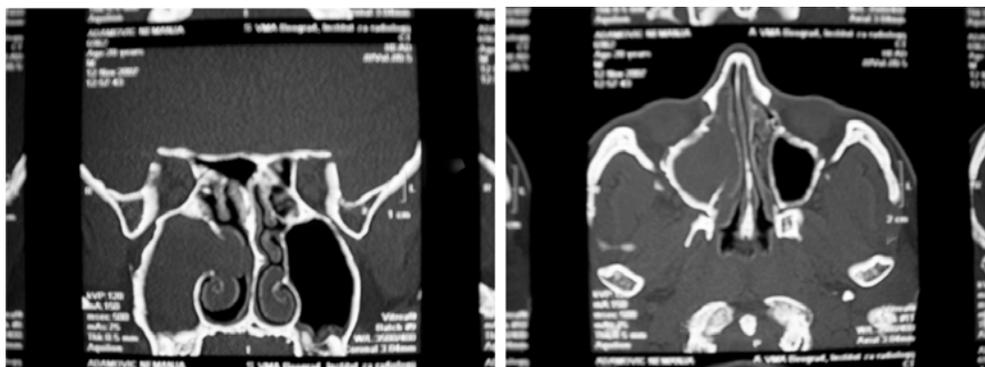


Fig. 1 – Coronal (A) and axial (B) computed tomography of the paranasal sinuses shows the complete opacification of the right maxillary sinus expanding into the nasal cavity through the medial wall

presenting symptoms resolved or improved. All the patients had a patent MMA and two had a patent IMA and healthy maxillary sinus and middle meatal mucosa at latest follow-up. No patients required revision surgery.

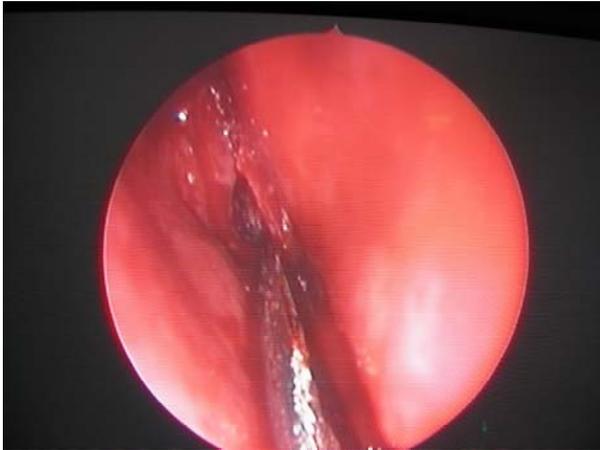


Fig. 2 – Endoscopic view of the right nasal cavity shows the anteromedially displaced uncinate process; after the incision of the uncinate process, a grayish mucocele wall was found

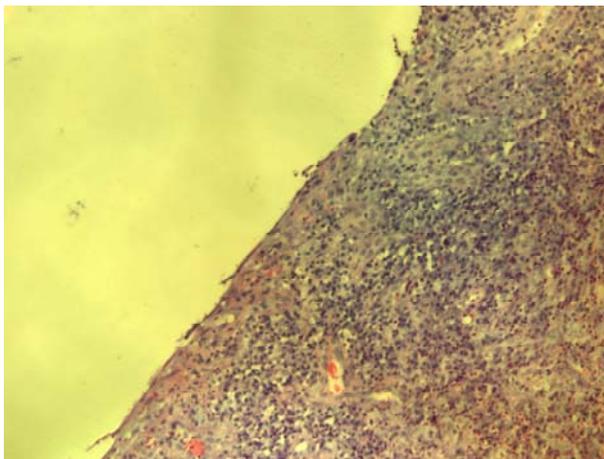


Fig. 3 – Mucocele lining composed of respiratory epithelium with variable flattening and attenuation of the pseudostratified columnar epithelium (H&E; 100x)

Discussion

The etiology and pathogenesis of mucoceles remain uncertain. A widely proposed theory is obstruction at or near the outflow tract of the appropriate sinus¹¹. Possible causes have been postulated to include osseous trauma, polyps, tumors, mucosal thickening, and previous surgery¹¹. It has been postulated that following obstruction of naturally ostium a superadded infection leads to chronic inflammation mediated by bacterial antigens⁷. Brook and Frazier¹² detected polymicrobial aerobic and anaerobic isolates in the mucocele by bacteriological culture examination. Furthermore, lipopolysaccharide, a component of the cell wall of gram-negative bacteria, is detected in fluids of paranasal sinus mucoceles at very high rates of incidence¹². Lipopolysaccharide

continued stimulation of lymphocytes and monocytes leads to the production of cytokines, which enhance PGE₂, and collagenase synthesis by fibroblasts in the lining mucosa^{7,12}. These factors in turn stimulate bone resorption and, so, accommodate mucocele expansion. A finding of Kariya et al¹³ suggests that interleukin-12 (IL-12) and Th1 cytokines interleukin-2 (IL-2) and gamma interferon (IFN- γ) may play a significant role in osteolysis of paranasal sinus mucocele. Immunohistochemical studies conducted by Lund et al⁷ have shown that mucocele lining contained potent osteolytic cytokines interleukin-1 (IL-1), interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF- α), which might be the factor causing erosion of bone overlying the expanding mucocele.

Traditionally, treatment for paranasal sinus mucocele involved complete removal of the sinus mucosal lining. However, it has been shown that the mucosa of a mucocele usually do not lose normal respiratory epithelium and follow-up endoscopic examination has also found well-mucosalized cavities after mucocele marsupialization^{8,9,14}. These findings suggest that there is no added benefit in attempting to remove the mucocele lining^{8,9,14}. On the other hand, the major problem of the external (Caldwell-Luc) operation is scarring of the facial soft tissue⁶. The most of patients with secondary mucoceles had had a previous history of Caldwell-Luc procedure^{14,15}. One postulated mechanism of formation of the postsurgical mucocele is the presence of fibrotic bands, which separate the anterior and posterior walls, thus interfering with normal drainage¹⁵.

Endoscopic sinus surgery is based on the theory that the natural maxillary sinus ostia are the most important areas in the pathogenesis of inflammatory diseases¹⁶. Based on this theory, surgical opening of the ostia and improved ventilation of the sinuses should restore the normal mucosal function¹⁶. Normal ventilation has probably an anti-inflammatory effect diminishing the symptoms¹⁶. Restoration of mucociliary clearance in the maxillary sinuses is believed to be essential to the success of ESS¹⁶.

In the Medline and Google search, we could find four similar retrospective studies in English which describe the clinical presentation of maxillary sinus mucoceles and establish the efficacy of their endoscopic management. In the articles written by Makeieff et al. (ten patients)², Busaba and Salman (13 patients)¹⁷, Dispenza et al. (four patients)¹⁸ and Caylakli et al. (14 patients)¹⁹, infundibulotomy with MMA and marsupialization of the mucocele were performed in almost all patients. All the authors concluded that endoscopic treatment appears to be effective and leads to minimal rate of complications and recurrence. The outcome confirms that this technique is the gold standard of treatment in this disorder. Makeieff et al.² and Dispenza et al.¹⁸ noted that complete removal of the mucocele wall is not necessary, thus avoiding the risk of iatrogenic lesions of neighbouring structures in case of a bony erosion (orbital floor, posterior wall of the maxillary sinus). In our study, we treated six patients by IMA simultaneously with MMA and had better postoperative benefits in ventilation and drainage. Ochi et al.²⁰ showed no case of mucus circular flow on the india ink test after performing inferior meatal

windows. Almost half sinuses exhibited a discharge from the inferior meatal antrostoma similar to the middle meatal²⁰. These findings suggest that IMA does not disrupt the intraoperative and postoperative mucociliary function. We, also, consider IMA to be a beneficial surgical procedure together with MMA.

Picavet and Jorissen²¹ found that three conditions can be considered risk factors for mucocele recurrence after ESS: surgery at a moment of acute infection, presence of multiple mucocèles, and significant extension outside the sinus wall. In some cases, however, the endoscopic technique can be difficult to perform due to the loss of essential anatomical landmarks and in these cases recourse to an external approach may be necessary². Bockmühl et al.⁶ noted contraindications for an endoscopic endonasal approach in the management of mucocèles: far laterally localized maxillary sinus mucocèles; in cases of revision surgery where the previous operation was external according to Caldwell-Luc; if maxillary sinus mucocèles are located within the zygomatic bone;

in cases when the mucocele is present with a cutaneous or oroantral fistula that needs to be excised; in cases of malignancy causing the mucocele.

Conclusions

According to our results and the experience of other authors, we conclude that MMA with marsupialization of mucocèles abolishes middle meatal obstruction and establishes better drainage and ventilation of the maxillary sinus and restitutes its mucosa. We, also, consider that IMA performed simultaneously with MMA is a beneficial complementary surgical procedure.

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